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PATENT

EXHIBIT C

Copy of the Initial Amendment and Response to Office Action filed as of May 31, 2001.

**COPY****IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant : Zhu et al.  
 Appl. No. : 09/318,073  
 Filed : May 25, 1999  
 For : THIN FILM MEMORY  
 DEVICE HAVING LOCAL  
 AND EXTERNAL  
 MAGNETIC SHIELDING  
 Examiner : L. Andujar

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 20231, on

May 31, 2001

(Date)

*Adeel S. Akhtar*  
 Adeel S. Akhtar, Reg. No. 41,394

**AMENDMENT & RESPONSE TO OFFICE ACTION**

Assistant Commissioner for Patents  
 Washington, D.C. 20231

Dear Sir:

In response to the Office Action mailed January 31, 2001 in the above-captioned application, Applicants respectfully request entry of the amendments indicated below and reconsideration of the claims in view of the amendments and remarks set forth below.

**IN THE SPECIFICATION:**

Please replace the title, "Local Shielding for Memory Cells" with --Thin Film Memory Device Having Local and External Magnetic Shielding--.

**IN THE CLAIMS:**

Please delete Claims 23-34 in accordance with an earlier Election of Species.

1. (Amended) A monolithically formed ferromagnetic thin film memory element in an integrated circuit, comprising:

magnetic storage means having an upper surface and a lower surface;

first shielding means having a soft magnetic material, said first shielding means positioned above the upper surface of the magnetic storage means; and

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second shielding means having a soft magnetic material, said second shielding means positioned below the lower surface of the magnetic storage means.

2. (Amended) A monolithically formed ferromagnetic thin film memory element, comprising:

magnetic storage means having an upper surface and a lower surface;

a word line having an inner surface and an outer surface;

a digital line having an inner surface and an outer surface, the inner surface of said digital line spaced from the inner surface of said word line, with the magnetic storage means positioned therebetween;

first shielding means having a soft magnetic material, said first shielding means positioned above the upper surface of the magnetic storage means and adjacent the outer surface of the word line; and

second shielding means having a soft magnetic material, said second shielding means positioned below the lower surface of the magnetic storage means and adjacent the outer surface of the digital line.

5. (Amended) A monolithically formed ferromagnetic thin film memory element according to claim 3, further comprising a first insulating means situated between said magnetic storage means and the inner surface of said word line.

6. (Amended) A monolithically formed ferromagnetic thin film memory element according to claim 5, further comprising a second insulating means situated between said magnetic storage means and the inner surface of said digital line.

9. (Amended) A monolithically formed magneto-resistive memory element, comprising:

a word line having an inner surface and an outer surface;

a digital line having an inner surface and an outer surface, the inner surface of said digital line spaced from the inner surface of said word line;

a magnetic bit region between the inner surface of said word line and the inner surface of said digital line;

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a first shielding layer having a soft magnetic material, the first shielding layer positioned adjacent the outer surface of the word line; and

a second shielding layer having a soft magnetic material, the second shielding layer positioned adjacent the outer surface of the digital line.

14. (Amended) A monolithically formed magneto-resistive memory element according to claim 9, further comprising a first insulating layer between said magnetic bit region and the inner surface of said word line.

15. (Amended) A monolithically formed magneto-resistive memory element according to claim 14, further comprising a second insulating layer between said magnetic bit region and the inner surface of said digital line.

16. (Amended) A monolithically formed magneto-resistive memory element according to claim 9, wherein the word line is positioned below said magnetic bit region and said digital line is positioned above said magnetic bit region.

20. (Amended) A monolithically formed magneto-resistive memory element according to claim 19, further comprising a first insulating layer between the inner surface of the word line and the magnetic bit region.

21. (Amended) A monolithically formed magneto-resistive memory element according to claim 20, further comprising a second insulating layer between the inner surface of the digital line and the magnetic bit region.

### REMARKS

#### Allowable Subject Matter

Applicants note with appreciation the finding of Claims 2-4, 7 and 8 to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In response, Applicants have rewritten Claim 2 in independent form to include all of the limitations of base Claim 1. Claims 3, 4, 7 and 8 all depend from amended independent Claim 2. Accordingly, Claims 2-4, 7 and 8 are in condition for allowance.

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### **Amendments to the Claims and Specification**

Applicants have amended the title of the invention as suggested by the Examiner.

Claim 1 has been amended as discussed in Rejections under 35 U.S.C. § 102(b) below.

Amendments have been made to Claims 5 and 6 to match follow-on recitations with their antecedents.

Applicants have amended Claims 9, 14-17, 20 and 21 to cancel the term "magnetic field sensitive region" and have replaced it with --magnetic bit region--.

Applicants respectfully submit that the amendments add no new matter and are fully supported by the application as originally filed.

### **Drawings Objection**

The Examiner has objected to the drawings for not showing the "magnetic field sensitive region." In response, Applicants have amended Claims 9, 14-17, 20 and 21 to cancel the term "magnetic field sensitive region" and have replaced it with --magnetic bit region-- as discussed on page 14 of the specification and shown in the drawings in Figure 11 as item 170. Applicants submit that the drawings are now in compliance with 37 CFR 1.83(a).

### **Rejections under 35 U.S.C. §112**

The Examiner has rejected Claims 5, 6 and 9-22 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Applicants have amended the dependency of Claims 5 and 6 to match follow-on recitations with their antecedents.

Independent Claim 9 recites a magneto-resistive memory element, comprising a word line having an inner surface and an outer surface; a digital line having an inner surface and an outer surface, the inner surface of said digital line spaced from the inner surface of said word line; a magnetic bit region between the inner surface of said word line and the inner surface of said digital line; a first shielding layer having a soft magnetic material, the first shielding layer positioned adjacent the outer surface of the word line; and a second shielding layer having a soft

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magnetic material, the second shielding layer positioned adjacent the outer surface of the digital line.

The Examiner asserts that Claim 9 does not show clearly if the memory element is contained between the first and second magnetic material.

Applicants refer to the specification on pages 5, line 23 - page 6, line 9, wherein is described, "A lower shielding layer and a lower barrier layer are provided on the bottom *and/or* side surfaces of a cavity. A lower conductive material layer is then provided in the cavity...The upper shielding layer may be provided along the top *and/or* sides of the digital line using conventional processing techniques." (emphasis added)

In light of the specification as described above, the location of the memory element is clear. Claim 9 recites a magnetic bit region between a word line and a digital line with a shielding layer (a soft magnetic material) adjacent an outer surface of the word line and a shielding layer (a soft magnetic material) adjacent an outer surface of the digital line. The soft magnetic material or shielding layer, may be on the bottom and/or side surfaces (all are outer surfaces) of the word line and on the top and/or side surfaces (all are outer surfaces) of the digital line.

Accordingly, Applicants submit that the rejection of Claim 9 for indefiniteness is overcome.

Dependent Claims 10-22 each depend from independent Claim 9 and therefore include all the features and limitations thereof. Furthermore, the dependent claims add further distinguishing features of particular utility. Accordingly, Applicants submit that the dependent claims are also in condition for allowance.

#### **Rejections under 35 U.S.C. § 102(b)**

The Examiner has rejected Claim 1 under 35 U.S.C. § 102(b) as being anticipated by Schapira (U.S. Patent No. 3,623,032).

Applicants have amended Claim 1 to recite a monolithically formed ferromagnetic thin film memory element in an integrated circuit. As known in the art, an integrated circuit refers to a circuit whose components are formed on a single semiconductor substrate.

Schapira taught a magnetic memory device in which no semiconductor substrate, in fact no substrate of any kind, was employed. Epoxy or resin was poured into a loom in which tunnel-

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forming wires had been stretched. The wires were pulled out and memory elements, composed of conductive wires coated with a layer of magnetic material, were inserted into the tunnels thus created. The memory device of Schapira was clearly not a monolithically formed thin film memory element in an integrated circuit.

Applicants respectfully traverse the rejections and submit that Schapira failed to teach each and every feature of amended Claim 1.

### CONCLUSIONS

In view of the foregoing amendments and remarks, Applicants submit that the application is in condition for allowance. If, however, some issue remains which the Examiner feels may be addressed by Examiner's amendment, the Examiner is cordially invited to call the undersigned for authorization.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is titled "Version with Markings to Show Changes Made."

Respectfully submitted,  
KNOBBE, MARTENS, OLSON & BEAR, LLP

**COPY**

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**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**In the Specification:**

Title: ~~Local Shielding for Memory Cell~~ Thin Film Memory Device Having Local and External Magnetic Shielding.

**In the Claims:**

Please delete Claims 23-34 in accordance with an earlier Election of Species.

1. (Amended) A monolithically formed ferromagnetic thin film memory element in an integrated circuit, comprising:

magnetic storage means having an upper surface and a lower surface;

first shielding means having a soft magnetic material, said first shielding means positioned above the upper surface of the magnetic storage means; and

second shielding means having a soft magnetic material, said second shielding means positioned below the lower surface of the magnetic storage means.

2. (Amended) A monolithically formed ferromagnetic thin film memory element ~~according to claim 1, further comprising:~~

magnetic storage means having an upper surface and a lower surface;

a word line having an inner surface and an outer surface;

a digital line having an inner surface and an outer surface, the inner surface of said digital line spaced from the inner surface of said word line, with the magnetic storage means positioned therebetween;



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first shielding means having a soft magnetic material, said first shielding means positioned above the upper surface of the magnetic storage means and adjacent the outer surface of the word line; and

second shielding means having a soft magnetic material, said second shielding means positioned below the lower surface of the magnetic storage means and adjacent the outer surface of the digital line.

5. (Amended) A monolithically formed ferromagnetic thin film memory element according to claim 3, further comprising a first insulating means situated between said magnetic ~~field-sensitive-bit region~~storage means and the inner surface of said word line.

6. (Amended) A monolithically formed ferromagnetic thin film memory element according to claim 5, further comprising a second insulating means situated between said magnetic ~~field-sensitive-bit region~~storage means and the inner surface of said digital line.

9. (Amended) A monolithically formed magneto-resistive memory element, comprising:

a word line having an inner surface and an outer surface;

a digital line having an inner surface and an outer surface, the inner surface of said digital line spaced from the inner surface of said word line;

a magnetic ~~field-sensitive-bit~~ region between the inner surface of said word line and the inner surface of said digital line;

a first shielding layer having a soft magnetic material, the first shielding layer positioned adjacent the outer surface of the word line; and

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a second shielding layer having a soft magnetic material, the second shielding layer positioned adjacent the outer surface of the digital line.

14. (Amended) A monolithically formed magneto-resistive memory element according to claim 9, further comprising a first insulating layer between said magnetic ~~field sensitive~~-bit region and the inner surface of said word line.

15. (Amended) A monolithically formed magneto-resistive memory element according to claim 14, further comprising a second insulating layer between said magnetic ~~field sensitive~~-bit region and the inner surface of said digital line.

16. (Amended) A monolithically formed magneto-resistive memory element according to claim 9, wherein the word line is positioned below said magnetic ~~field sensitive~~-bit region and said digital line is positioned above said magnetic ~~field sensitive~~-bit region.

20. (Amended) A monolithically formed magneto-resistive memory element according to claim 19, further comprising a first insulating layer between the inner surface of the word line and the magnetic ~~field sensitive~~-bit region.

21. (Amended) A monolithically formed magneto-resistive memory element according to claim 20, further comprising a second insulating layer between the inner surface of the digital line and the magnetic ~~field sensitive~~-bit region.